

CLAIMS

1. An indium phosphide substrate containing a dopant, comprising:

an average dislocation density value of a wafer being less than 5000 cm^{-2} ;

5 a ratio of the difference between a maximum value and a minimum value with respect to an average value of dopant concentration in said wafer being 30% or less;

a substantially uniform distribution of said dopant concentration in the depth direction of said wafer.

10 2. An indium phosphide substrate containing a dopant, comprising:

an average dislocation density value of a wafer being less than 2000 cm^{-2} ;

a ratio of the difference between a maximum value and a minimum value with respect to an average value of dopant concentration in said wafer being 30% or less;

15 a substantially uniform distribution of dopant concentration in the depth direction of said wafer.

3. An indium phosphide substrate as described in Claim 1 or 2, wherein:

diameter of said substrate is 75 mm or greater.

4. An indium phosphide substrate as described in one of Claims 1 through 3,

20 wherein:

diameter of said substrate is 100 mm or greater.

5. An indium phosphide substrate as described in one of Claims 1 through 4, wherein:

said dopant is Fe (iron).

6. An indium phosphide substrate as described in one of Claims 1 through 4, wherein:

said dopant is S (sulfur).

5 7. An indium phosphide substrate as described in one of Claims 1 through 4, wherein:

said dopant is Sn (tin).

8. An indium phosphide substrate as described in one of Claims 1 through 4, wherein:

10 said dopant is Zn (zinc).

9. An indium phosphide crystal containing a dopant, comprising:

direction of growth being $\langle 100 \rangle$ orientation;

an average dislocation density value on a (100) plane, which is perpendicular to said growth direction, being less than 5000 cm^{-2} .

15 10. An indium phosphide crystal containing a dopant, comprising:

direction of growth being $\langle 100 \rangle$ orientation;

an average dislocation density value on a (100) plane, which is perpendicular to said growth direction, being less than 2000 cm^{-2} .

11. An indium phosphide crystal as described in Claim 9 or 10, wherein:

20 diameter of said crystal is 75 mm or greater.

12. An indium phosphide crystal as described in one of Claims 9-11, wherein:

diameter of said crystal is 100 mm or greater.

13. An indium phosphide crystal as described in one of Claims 9 through 12,

wherein:

said dopant is Fe (iron).

14. An indium phosphide crystal as described in one of Claims 9 through 12,
wherein:

5 said dopant is S (sulfur).

15. An indium phosphide crystal as described in one of Claims 9 through 12,
wherein:

said dopant is Sn (tin).

16. An indium phosphide crystal as described in one of Claims 9 through 12,
10 wherein:

said dopant is Zn (zinc).

17. A method for manufacturing an indium phosphide monocrystal containing
a dopant, comprising:

placing a seed crystal, which has a cross-sectional area of 15% or greater
15 of a cross-sectional area of a crystal body, at a lower end of a growth container
so that direction of growth of said crystal is <100> oriented;

placing said growth container containing said seed crystal, indium
phosphide raw material, dopant, and boron oxide in a crystal growth chamber,
and raising the temperature to at or above the melting point of indium
20 phosphide;

after heating and melting boron oxide, indium phosphide raw material,
dopant, and a portion of said seed crystal, lowering the temperature of said
growth container in order to grow a monocrystal with a <100> orientation in a

longitudinal direction of said growth container.

18. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in Claim 17, wherein:

5 said seed crystal has a cross-sectional area of 50% or greater of a cross-sectional area of said crystal body.

19. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in Claim 17 or 18, wherein:

 said seed crystal has a cross-sectional area of 98% or less of a cross-sectional area of said crystal body.

10 20. A method for manufacturing an indium phosphide monocrystal as described in Claims 17-19, wherein:

 in a longitudinal cross-section which includes a crystal central axis, a slope angle of a tapering region from said seed crystal to said crystal body with respect to said crystal central axis is 40 degrees or less.

15 21. A method for manufacturing an indium phosphide monocrystal as described in Claims 17 through 19, wherein:

 in a longitudinal cross-section which includes a crystal central axis, an angle of a tapering region from said seed crystal to said crystal body with respect to said crystal central axis is 20 degrees or less.

20 22. A method for manufacturing an indium phosphide monocrystal as described in Claims 17-21, wherein:

 said seed crystal has an average dislocation density of less than 5000 cm⁻².

23. A method for manufacturing an indium phosphide monocrystal as

described in Claims 17-21, wherein:

said seed crystal has an average dislocation density of less than 2000 cm⁻².

24. A method for manufacturing an indium phosphide monocrystal as described in Claims 17-23, wherein:

5 said seed crystal has an average dislocation density that is lower than a target average dislocation density of said crystal which is to be grown.

25. A method for manufacturing an indium phosphide monocrystal as described in Claims 17-24, wherein:

10 after maintaining said indium phosphide raw material, dopant, and a portion of said seed crystal in a heated melted state for a fixed period of time, the temperature of said growth container is lowered in order to grow a monocrystal with a <100> orientation in a longitudinal direction of said growth container.

15 26. A method for manufacturing an indium phosphide monocrystal as described in Claim 25, wherein:

20 after maintaining said indium phosphide raw material, dopant, and a portion of said seed crystal in a heated melted state for 1 hour or more, the temperature of said growth container is lowered in order to grow a monocrystal with a <100> orientation in a longitudinal direction of said growth container.

27. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in Claims 17-26, wherein:

growth rate when growing said crystal from said seed crystal is 10

mm/hour or less.

28. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in Claims 17-26, wherein:

growth rate when growing said crystal from said seed crystal is 5
5 mm/hour or less.

29. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in Claims 17-28, wherein:

growth rate when growing said crystal from said seed crystal is 2.5
mm/hour or greater.

10 30. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in one of Claims 17-29, wherein:

said growth container is a pBN (pyrolytic boron nitride) container.

31. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in one of Claims 17-30, wherein:

15 prior to housing said seed crystal, indium phosphide raw material, dopant, and boron oxide in said growth container, an inner surface of said growth container, at least a part which will come into contact with melt, is coated with a boron oxide film.

32. A method for manufacturing an indium phosphide monocrystal containing
20 a dopant as described in one of Claims 17-31, wherein:

said crystal body has a diameter of 75 mm or greater.

33. A method for manufacturing an indium phosphide monocrystal as described in one of Claims 17-32, wherein:

said crystal body has a diameter of 100 mm or greater.

34. A method for manufacturing an indium phosphide monocrystal as described in one of Claims 17-33, wherein:

said dopant is Fe (iron).

5 35. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in one of Claims 17-33, wherein:

said dopant is S (sulfur).

36. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in one of Claims 17-33, wherein:

10 said dopant is Sn (tin).

37. A method for manufacturing an indium phosphide monocrystal containing a dopant as described in one of Claims 17-33, wherein:

said dopant is Zn (zinc).